ROTUNDA

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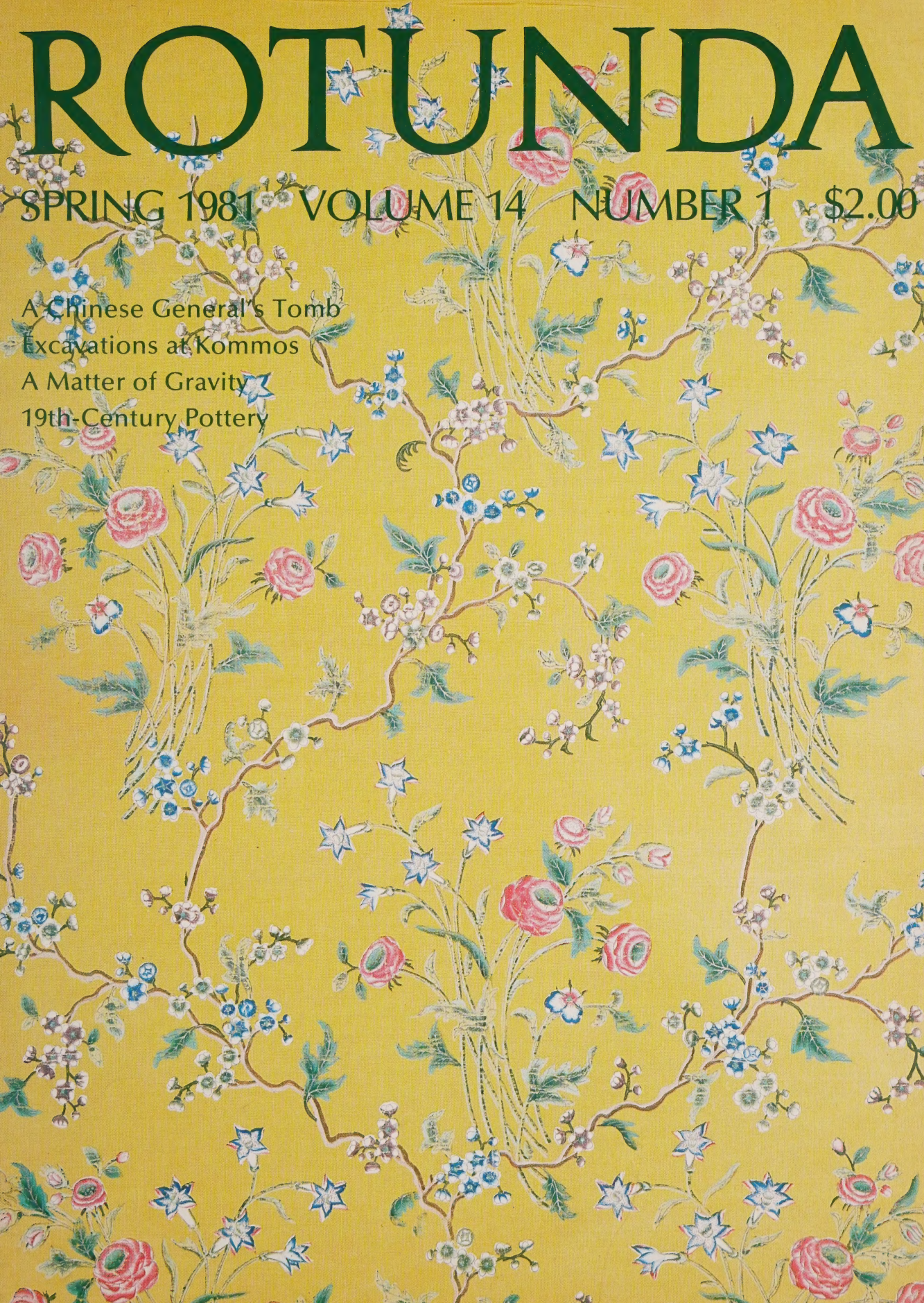
A Chinese General's Tomb
Excavations at Kommos
A Matter of Gravity
19th-Century Pottery



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ROTUNDA

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Cover photo: Panel of an unmade dress, 18th century, described on p. 28.
(Photo Brian Boyle, Photography Department, ROM)

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Focus on . . .

A Michele da Firenze Terracotta Relief in the ROM

K. Corey Keeble

IN 1924 THE ROM ACQUIRED a small terracotta slab on which was depicted in relief the figure of an archangel standing in a niche flanked by fluted pilasters. Little is known of its provenance. It appears to have been purchased in Rome, probably in November 1923, and may have been among a number of terracottas and bronzes of Roman origin that Thomas Sutton (acting as agent for Charles Trick Currelly, then director of the ROM) located in a private collection.

When the slab arrived in Toronto, it was listed simply as a transom, and was entered into the Museum's records with a meagre description giving only dimensions, colour, material, and immediate source, and no information concerning attribution, authenticity, and date. These gaps in our knowledge of the slab persisted until the summer of 1980, when research in the European Department revealed that the terracotta is from the workshop of an early 15th-century Italian sculptor called Michele da Firenze—also known as "The Master of the Pellegrini Chapel", a chapel in the church of Sant' Anastasia in Verona.

The name Michele da Firenze, in addition to denoting a specific sculptor, is currently used as a label of convenience under which works of similar style may be grouped. In this sense, the name Michele da Firenze refers to a large body of terracotta reliefs all fashioned in the same manner and in the same workshop in the region around Verona in the early and middle 1400s. It is now clear that the ROM terracotta is a product of that workshop, in which certain Tuscan stylistic qualities were blended with those of northern Italy, probably with an infusion of influences from the area around Venice.

The armour-clad archangel of the ROM terracotta is reminiscent of a much larger and more detailed terracotta of the archangel Michael occupying a niche in the Pellegrini Chapel. The Pellegrini Chapel reliefs, dating from the mid-1430s, have been attributed to Michele da Firenze on the basis of a document which records payment made to him in 1436 in connection with the terracotta decoration of the chapel. There are many stylistic affinities between the Toronto relief and the Pellegrini ones. For example, in the chapel's Nativity panel, the draperies of Joseph, Mary, and the angels hovering over the stable have the same limpid folds and same International Gothic style that appear in the ROM relief. Furthermore, the Pellegrini reliefs show the same modelling conventions in the head and hand details that appear in the Toronto relief. Likewise, in the Pellegrini *Adoration of the Kings*, it is possible to see the same modelling style as appears in the Toronto relief.

On the basis of stylistic affinities, numerous other terracotta reliefs have been attributed to Michele da Firenze. Among them are terracotta relief fragments in the collections of both the Museo Civico in Treviso and the Museo Bocchi in Adria, as well as a major altar in the Duomo at Modena, and the tomb of Francesco Rosselli in the church of San Francesco at Arezzo. The little ROM terracotta has features in common with all these works; particularly apparent are the architectural similarities between the ROM relief and the Rosselli tomb. The archangel's niche in the ROM relief is flanked by fluted pilaster strips that are miniature versions of the more elaborate Rosselli tomb pilasters, with a similar form of capital. The same form of floral decoration, though much stylized and reduced in the Toronto relief, appears in the spandrels of the semi-circular arch over the Rosselli tomb.

It is also interesting to compare the Toronto relief with a little-known terracotta slab acquired in 1887 in Arezzo by the Kaiser Friedrich Museum, Berlin. The Berlin terracotta features a relief of a bishop standing in a niche. Although somewhat larger than the Toronto relief, its architectural details are virtually identical, with the same type and arrangement of pilasters, including the shorter pilasters above the main ones, the same kind of moulded base, the same kind of shell-like fluting in the arch, and the same kind of debased Late Gothic foliage. It is intriguing to speculate on the similarities in the Toronto archangel, the Rosselli tomb sculptures, and the Berlin terracotta. It is possible that the Toronto relief came from the same area as the Berlin relief, or even from the same altar-piece. It is probable that the two came from the same workshop and were made at about the same time.

The Victoria and Albert Museum in London has a Madonna relief attributed to Michele da Firenze which, though highly Gothic in style, incorporates fluted pilasters similar to those in the Toronto relief. This London terracotta, incorporating the figures of St. John the Baptist and St. James on either side of an enthroned Madonna and Child, includes the same cusped and fluted elements in the arch, the same pronounced moulding over the arch, and the same kind of limp foliage that appear in the ROM relief and the Rosselli tomb sculptures.

The Toronto relief is unusual in its classical detailing. Works attributed to Michele da Firenze more frequently have Gothic or Italian Romanesque architectural details. However the architectural components of the ROM relief appear closer to classical Tuscan ones. In fact, the division of the pilasters in the ROM terracotta, with a short section above the main strip, recalls the architectural frames around

The orange-coloured terracotta slab is 43 cm high, 24.4 cm wide, and 11 cm thick.

the sculptures of the Florentine Guild church of Or San Michele, the site of many of the most important Florentine sculptural commissions of the early Renaissance.

Ulrich Middledorf, one of this century's foremost authorities on Renaissance sculpture replied to the ROM's letter of inquiry about the origin of its terracotta saying: "This really is a remarkable discovery; it undoubtedly is a piece in the style of the 'Master of the Pellegrini Chapel,' Michele da Firenze, or how[ever] you want to call him. . . . It is typical in every respect and particularly interesting as it is the most classical [of his] that I have ever seen. . . . There cannot be any doubt that the piece is authentic."

The authenticity of the relief is further supported by thermoluminescent tests carried out in the summer of 1980 by Washington University, St. Louis, Missouri. These tests indicate that the last firing of the clay occurred in the 15th century.

It is important to point out that art historians in the 19th and 20th centuries have differed in their attributions of many of these works. Wilhelm von Bode, one of the great pioneer scholars in the field of Renaissance sculpture, first recognized that works such as the Pellegrini reliefs, the Modena altar, and the Rosselli tomb had much in common, and attributed them all to an anonymous Quattrocento master whom he called "The Master of the Pellegrini Chapel". Bode's grouping of these works around one master was accepted by some later art historians, and challenged by others. In 1908 Adolfo Venturi attributed those terracottas to two separate sculptors, referred to as the "Pellegrini Master" and the "Modena Master". In 1940, Jolán Balogh attempted a further division by recognizing a separate "Master of the Rosselli Tomb". However in 1932 Giuseppe Fiocco in the Italian periodical *Dedalo* had attributed all of these major works to Michele da Firenze on the basis of documentation connecting him with the work for the Pellegrini Chapel. Most art historians have followed Fiocco's lead.

Much work remains to be done in the study of terracottas now attributed generally to Michele da Firenze. We need to know more about him specifically, and more about the movements of artists associated with his workshop. The solution of this extremely complicated problem will be aided by the ROM's little terracotta slab. The small, seemingly insignificant, terracotta is an important discovery for current studies of European Renaissance sculpture.

K. Corey Keeble is Assistant Curator in the European Department of the ROM.

Detail of terracotta.

Photos: Photography Department, ROM

Dr. Theodore Allen Heinrich (1910–1981)

DR. THEODORE A. HEINRICH, Director of the Royal Ontario Museum from 1955 to 1962, died on Tuesday, 27 January 1981. The museum community is greatly diminished by the loss of this brilliant and cosmopolitan man, who in his term of office did much to shape the direction of the ROM.

An American by birth, Dr. Heinrich came to the ROM with impeccable credentials in art history and degrees from the University of California and King's College, Cambridge. His postgraduate studies took him to universities at Tours and Bonn, and he had further experience in Europe during World War II as a member of the Intelligence Staff of Supreme Headquarters Allied Expeditionary Force under General Eisenhower. One of the most fascinating aspects of his career was his five years' service to the postwar German government in the recovery, identification, and restitution of works of art looted under the Nazi regime. On his return to America he became Curator of Art Collections at the Henry E. Huntington Library and Art Gallery of San Marino, California, and subsequently Associate Curator of Paintings at the Metropolitan Museum of Art, New York.

Dr. Heinrich arrived at the ROM at a crucial time in its history; 1955 was the year in which the autonomous museums of Geology and Mineralogy, Zoology and Palaeontology, and Art and Archaeology and the Education Department were amalgamated to become one museum with a single director and a centralized administration. As the first director of the amalgamated Royal Ontario Museum, Dr. Heinrich made a number of significant contributions, not the least of which was the strengthening of relationships among separate divisions to provide the Museum with the interdisciplinary reputation it enjoys today.

Dr. Heinrich was responsible for initiating many ROM projects and programmes of a kind now taken for granted. Under his stewardship an increased number of overseas field trips, to such diverse areas as Jerusalem, Peru, Central America, and Trinidad, added greatly to the international scope of both collections and scholarship. Closer to home, expeditions to Quebec's Chubb Crater and the Serpent Mounds of Rice Lake and trips by Education Department staff to such remote areas as Moosonee served to enlarge the ROM's Canadian holdings and interests. At the same time he negotiated successfully for substantial government grants for new acquisitions.

Dr. Heinrich recognized the need for growth not only in collections and scholarship but in public interest as well. He attracted new friends and generous gifts for the ROM and initiated a programme of major exhibitions and lectures. The late Mr. Harold M. Turner, as Chairman of the Board of Trustees, recognized Dr. Heinrich's talent as a museum booster when he stated in 1957, "Currelly created the Museum, but Heinrich sold it." The increased Museum attendance during his directorship and the celebrations that marked our 50th anniversary attest to his success in this area.

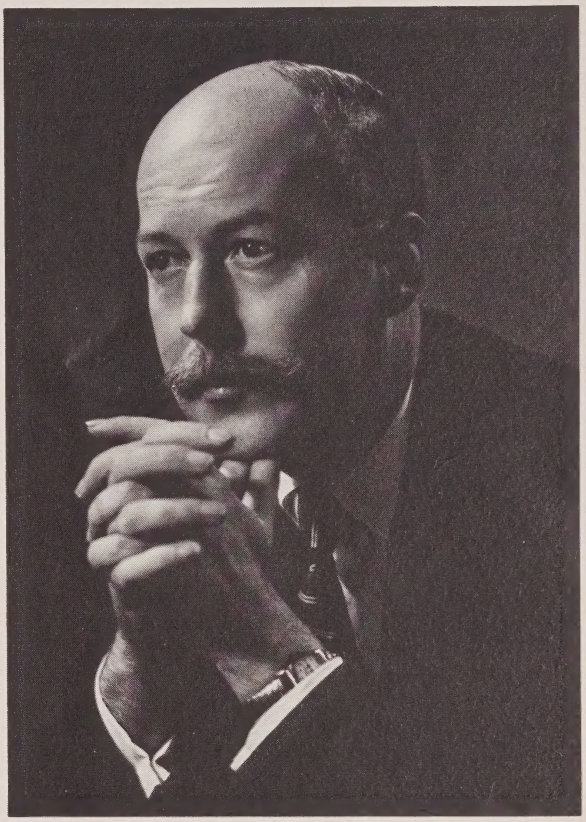
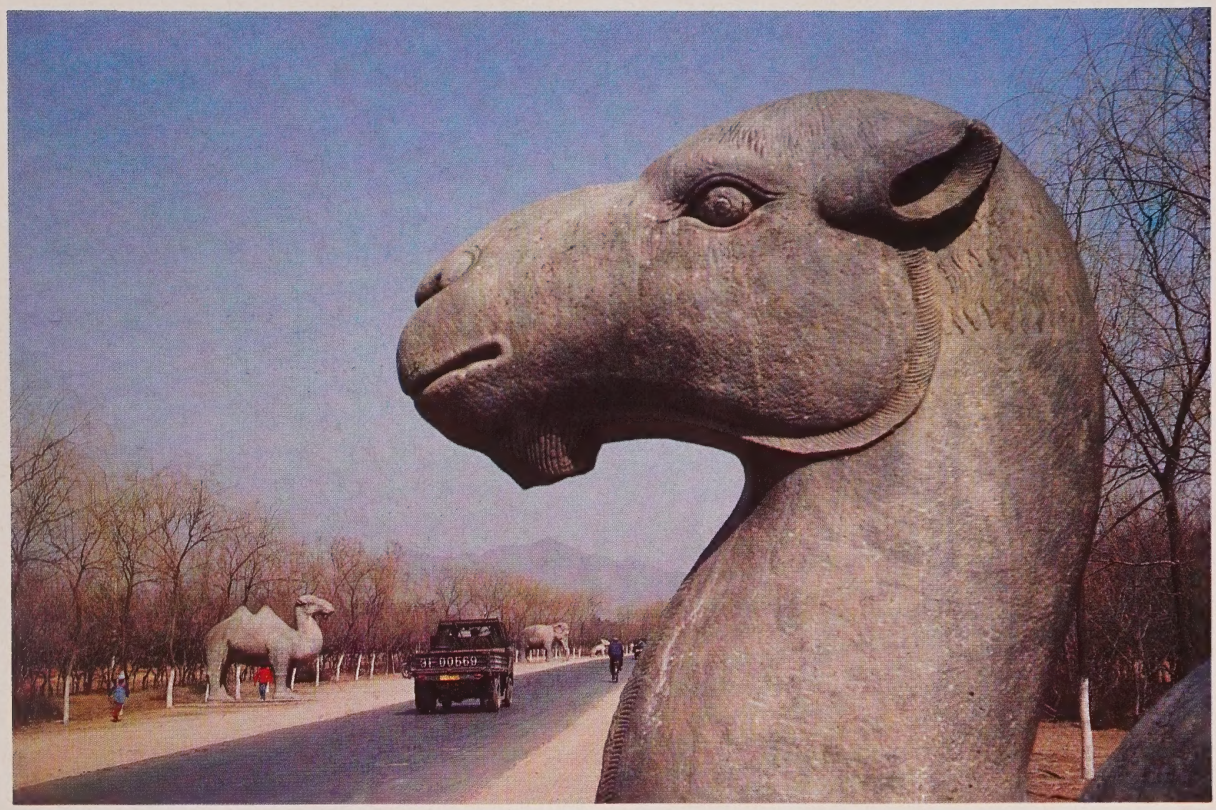


Photo: Gabriel Desmarais, Montréal.

Within the Museum, Dr. Heinrich's impact was felt on many levels. New support departments, such as Photography and Information Services, were established and continue today—some under different names—as integral parts of the Museum. His concern with improving staff relations and salaries won him a lasting respect and affection among his colleagues.

Above all, Dr. Heinrich was a man with a museum vision. The early plans for expansion, established under his leadership, have provided the base on which we move forward today. Although a vital link with the past has been severed, Dr. Heinrich's influence on and ambitions for the Royal Ontario Museum are a legacy for countless years to come.



A Chinese General's Tomb

Identification of the "Ming Tomb"

Barry Till

THE MING TOMB, as it is known, is one of the most popular exhibits in the Royal Ontario Museum. It consists of two impressive gateways, a pair of stone reclining camels, two stone men, a small stone altar, and the actual tumulus, which is made of cement. For years the tomb stood outdoors in the Chinese Garden, but once the renovation and expansion of the ROM are complete, it will have a place inside, where it will be protected from the ravages of the weather and pollution.

Very little has been written about the general whose tomb it is. We knew that his name was Tsu Ta-cheou and that he was a general during the Ming Dynasty (A.D. 1368–1644), but apart from these facts we had no knowledge of his life or of when he lived. Because his name is recorded in the old ROM archives not in Chinese characters but only in an unusual Romanization of the Chinese sounds, it is almost impossible to search for his biography in the Chinese records of the Ming Dynasty. Judging by the size and layout of his tomb, however, the

Above: Stone camels at the cemetery of the Ming emperors in Peking.

Opposite page: Boys playing on statue at tomb of General Chang Yu-chun of the Ming Dynasty—near Nanking.

Top: The ROM tomb alley, formerly in the Chinese Garden.

Bottom: The cement tumulus of the ROM tomb at its original location in Hopei Province, China.

general was certainly an important man, and there should therefore be some way of discovering his identity.

George Crofts, who was an English fur merchant in China early in this century, purchased the general's tomb for the ROM in the province of Hopei in 1918. The information and pictures that accompanied the artifacts to the ROM are muddled and inconclusive. Rather than rely heavily on the confusing stories in the archives, I decided to try some other method of discovering the identity of the general.

One way of determining the date of the tomb more exactly is by stylistic analysis. According to the records, the tomb of Tsu Ta-cheou had a tomb alley, sometimes called a "Spirit Path", lined with stone sculptures consisting of two men, two camels, two horses, two lions, two tigers, and other small animals. Of these, George Crofts purchased and sent to the ROM only the two camels and the two men. Beyond the stone statues of the tomb alley stood two gateways, about 140 m apart, which George Crofts also purchased for the ROM. Originally one of the gateways was dated to the T'ang Dynasty (A.D. 618–906) and the other to the Ming Dynasty. It would be virtually impossible, however, for one of the gateways to be T'ang since its condition is too good for it to have come from such an early period. Moreover, the style of its arch is not T'ang Dynasty but Ming Dynasty or Ch'ing Dynasty (A.D. 1644–1911).

Beyond the second gateway stood the cement tumuli of General Tsu Ta-cheou, members of his

family, and his soldier-servant. George Crofts also obtained the tumulus of General Tsu and a nearby stone altar for the ROM. During my three-year stay in China, I became very interested in the layouts of ancient Chinese tombs and visited more than a hundred tomb sites dating from the 2nd century B.C. to the early 20th century. The only tombs with cement tumuli that I saw are dated from the Ch'ing Dynasty.

A look at some other Ming Dynasty tombs in China should help us to find an approximate date for the general's tomb. In Nanking, the early Ming capital, there are several tombs of Ming generals. The stone statues that line their tomb alleys usually include a tortoise with a tablet on its back, a pair of horses, a pair of sheep, a pair of tigers, a pair of military officials, and a pair of civil officials. About forty-five metres from this avenue there is an earth tumulus containing the body of the deceased. However, none of these tombs has stone camels or lions like those in the tomb alley of General Tsu. The tombs of the Ming emperors in Nanking and Peking have more elaborate tomb alleys with lions, camels, elephants, horses, mythical animals, military and civil officials, and archways. It seems that during the Ming Dynasty lions and camels were reserved for the tombs of the emperors and their families, and thus it is rather peculiar that the tomb of General Tsu should have stone camels and lions.

In studying the statues of the military and the civil official of the ROM tomb complex, I noticed that they were slightly different from the Ming statues I had

Top: Tomb alley of General Li Wen-chung of the Ming Dynasty—in a field near Nanking.

Bottom: Tomb alley of a Ming general named Teng Yu—outside a factory near Nanking.

seen in Nanking and Peking but that they had some similarity to early Ch'ing tomb statues in Ch'u-fu in the province of Shantung. Thus there seemed to be at least some evidence for attributing the "Ming" tomb to a later date. Could our Ming general be a Ch'ing person?

Here we must go back to the problem of the general's name. We had no record of the Chinese characters for Tsu Ta-cheou, and the Romanization of the name seemed to be inconsistent. After making comparisons with different systems of Romanization, I found that "Tsu Ta" conforms to the widely used Wade-Giles system of Romanizing characters and that "cheou" conforms to the French system. If we use the Wade-Giles system of Romanizing for the full name, we get "Tsu Ta-shou". With this new name in mind, I examined Ming Dynasty biographies, but still I met with no success. As the style of the general's tomb seemed to point to an early Ch'ing Dynasty date, I decided to check the biographical records of the Ch'ing Dynasty as well. Finally, in these records, my effort was rewarded. There was a general named Tsu Ta-shou who died in 1656 in the early Ch'ing period.

His biographical record tells us that Tsu Ta-shou was a prominent military figure of the end of the Ming Dynasty, who had much success in defending China's northern boundary against the attacks of the Manchus. Because of this success, in 1628 the Ming emperor promoted him to brigadier-general of the border troops. In 1631, while General Tsu was inspecting one of the border fortifications, the city was surrounded by the powerful Manchu army. After a bitter siege of eighty days, Tsu was finally forced to surrender, since two-thirds of the population had perished, either of starvation or in battle. The Manchu leader, Abahai, admiring the courage of General Tsu, invited him to join forces with the Manchus and help them to take the city of Chin-chou. Tsu pretended he was willing to cooperate and suggested that he should retreat to the city and persuade the local population to surrender to the Manchus.

Abahai agreed to this plan but asked that Tsu's sons be left behind as hostages to ensure that Tsu kept his word. Tsu entered Chin-chou and soon took command. However, rather than handing the city over to the Manchus, he valiantly defended it against them for the next ten years. In 1642 the Manchus were finally able to wear down the stubborn resistance of the city and capture it; Tsu had to surrender. Abahai received him in audience with all courtesy; instead of punishing Tsu for his betrayal, Abahai made him a brigadier-general in the Chinese division of the Manchu army.

A few years later, in 1644, the Manchus took the Ming capital of Peking and established the Ch'ing Dynasty, which lasted until 1911. Tsu appears to have taken no great part in the affairs of the Ch'ing Dynasty. Nonetheless, when he died in Peking in 1656, the first Ch'ing emperor ordered that he be

祖大壽

Above: The Chinese characters for Tsu Ta-shou (written by Ka Bo Tsang, Far Eastern Department, ROM)

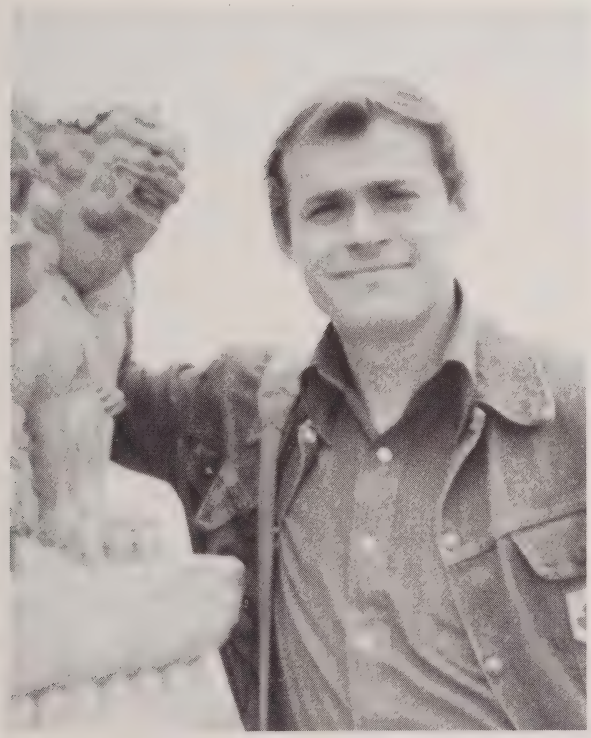
Right: Boys playing at unidentified Ming tomb near Nanking.

buried with full honours. After Tsu's death, several members of his family continued to serve the Ch'ing government; two of them became viscounts. General Tsu had a long and colourful career and these are only a few of the major facts about his life.

Since the Tsu family was very important, their cemetery was quite impressive with archways and stone statues. After the Ming Dynasty was overthrown, the strict rules for laying out tombs according to rank were no longer in effect. As a result, General Tsu's tomb, which was constructed in a transitional period, could include the stone camels and lions once reserved for the tombs or cemetery of the emperor and his family.

Thus we know that Tsu Ta-shou was for a time a Ming general, though he died during the Ch'ing Dynasty. Technically, therefore, the tomb in the ROM should no longer be called the Ming tomb but should be called the Ch'ing tomb. On the other hand, the ROM would be perfectly justified in calling it "the tomb of a Ming general", since Tsu is most noted for his role as a Ming general and for his loyalty to the Ming throne. The fact that the tomb dates from the Ch'ing Dynasty in no way diminishes its importance. The new identification should only increase the prestige of the ROM complex, since it was the tomb of a very renowned and honoured figure listed in Chinese literature among the most distinguished men of his time.

Tomb alley at the tomb of General Hsu Ta of the Ming Dynasty—in Nanking.



Barry Till was a temporary assistant (filling in for Patty Proctor) in the Far Eastern Department of the ROM. After receiving his M.A. in Far Eastern Studies at the University of Saskatchewan in 1975, he began a D.Phil. at the University of Oxford. His studies were interrupted when he won an exchange scholarship to China in 1977. From 1978 to 1980, he studied Chinese archaeology and ancient history at the University of Nanking. While in Nanking, he wrote a book entitled In Search of Old Nanking. *His main interests are stone sculptures and terracotta figurines found at tombs.*

Photos: p. 8 (2) ROM Archives; pp. 7, 11 (bottom) Paula Swart-Till; pp. 6, 9 (2), 10, 11 (top) Barry Till.

Right: Polychrome patterned cup ca. 1700 B.C., found in one of the Minoan houses at Kommos. (The watercolour of the restored cup is by G. Bianco.)

Below: View of Greek sanctuary from southeast, showing the most recent Greek temple (C) at left, and associated structures, including four altars in the foreground.

Joseph W. Shaw and Maria C. Shaw

Recent Discoveries in Crete

Excavations at Kommos

THE ISLAND OF CRETE in the southern Aegean Sea is best known for its Minoan civilization which flourished during the Bronze Age in the 2nd millennium B.C. Palaces and many settlements on Crete were excavated primarily in the early part of this century. Among them was the famous palace at Knossos, whose legendary king, Minos, supplies the label for this civilization. These excavations yielded delightful figurines in clay, beautifully patterned pottery, carved ivories, repoussé bronzes, and occasionally murals of astounding spontaneity, all well known from museum displays and publications.

At Kommos, an ancient site on the southern coast of Crete, a team of archaeologists from the University of Toronto, the Royal Ontario Museum, and other institutions has been excavating for the last five years what seems to have served as the chief harbour town of the nearby Minoan sites of Phaestos and Hagia Triadha. Kommos, with a long history of Minoan use lasting some 800 years (ca. 2000 to 1200 B.C.), held a surprise for the excavators who discovered that, after a lapse into obscurity after 1200 B.C., it reentered the historical scene as an important cult centre.

The present article concentrates on a special part of this rich history, a period of revival between the 10th and the 7th century B.C. which launched the Hellenic era, or in more familiar terms, Greek civilization. This was the period during which the seeds were sown for the future development of monumental Greek sculpture and architecture. These humble beginnings in Crete and elsewhere in Greece are all the more exciting because of their embryonic nature and the fact that they are so little known.

As might be expected during such a period, archi-

tecture was very simple, but it progressed steadily. Mud brick and rough rubble walls were eventually replaced by dressed stone blocks, the kind of masonry likely to survive the passage of time and to leave recognizable remains. Walls of this quality provided us with evidence that people started building at Kommos once again sometime in the 10th century B.C.

One would like to know what the attraction of the site was at that time. Was it the spectacular location on the fringes of the Libyan Sea and its mercantile potential? Was it a fascination with the still partially visible Minoan walls sticking up from the earth? Was it the abundant fresh water in the ground that provided the chief incentive? Perhaps all these reasons played a role, but one fact is certain: these newcomers selected as a place for worship a location right next to a Minoan building (labelled by us J) which has proved to be the most substantial one of that era in the present excavations at Kommos. Building J was built near the shore and its vast dimensions and beautiful masonry, consisting of finely cut, huge blocks laid in neat courses, suggest an important edifice, perhaps connected with the control of the harbour trade. The first visitors after 1200 B.C. must have been awestruck. Certainly this was the work of giants; perhaps the buildings were part of a heroic past whose vivid memory had been preserved from the Bronze Age in tales passed from generation to generation and finally crystallized in the Homeric epics. Here, then, the newcomers built their first temple (A) at a venerated spot to which their descendants were to cling tenaciously for over a thousand years. Temple A was succeeded by two more temples, one (B) built in the 8th century B.C., the other (C) built in the 4th century B.C., and still in use until sometime in the 2nd century A.D.

This layering of successive temples is unusual in Crete, though it has been encountered elsewhere in the Aegean area, namely at the Temple of Apollo at Thermon in northern Greece and at the Temple of Hera on the island of Samos, off the coast of Turkey. The presence of archaeological layers at Kommos was fortunate; the only problem was that the latest temple was so well preserved that its underlying predecessors could be only partially investigated. This was done by removing temporarily a number of the floor slabs of temple C and then digging, in

View of a large Minoan building (J) next to the sea.

Left: Impressive layering of architectural remains can be seen in this photograph. Minoan walls are at the bottom, and the west walls of Greek temples B and C are higher up.

Below: This beautifully detailed laurel wreath made of bronze and ivory was once an offering in temple C. The wreath probably dates from the Hellenistic era.

cramped spaces, some of the layers underneath.

Thus, of the first temple (A) we have seen only the northeast corner and part of a sill of an entrance leading into it from the east. Next to the northern wall was a stone bench which (judging by a similar bench from the latest temple which seems to have followed the original plan in its essentials) must have continued along the opposite wall. Just outside the entrance lay the terracotta leg of a bull figurine and a bronze arrowhead. Crushed upon the temple's earliest floor were cups of the Early Protogeometric style, most likely dating to the 10th century B.C., making this the earliest Greek temple so far known in Crete. More objects associated with ritual were strewn outside the building to its south.

The second temple (B) is of special interest. We know more about it, since more of it could be exposed in our probe. Like temple A, it was open to the rising sun in the east, as most Greek temples are. Its exterior dimensions were calculated to be 6.29 m × 8.22 m and its walls were made up of cut, often large, stone blocks, carefully set together. One entered the building from the east, through the entrance marked by a central pillar which helped support the flat roof. Along the north exposed wall ran a fine bench, its stone blocks smooth from use. On the axis at the rear of the room, in the place where the cult statue stood in later Greek temples, was a very curious structure, unlike any we know from the Aegean area. It consisted of three oblong limestone pillars, tapering at the top and mortised into a large block which served as their base. If the three pillars were ever painted, any trace of paint has gone, and the only form of ornament is a rectangular depres-

Above: Excavation under the slab floor of temple C reveals parts of earlier temples underneath. View is from the southeast.

Top: View of Kommos from the south after five years of excavation.

Left: Bronze figurine of a horse dedicated at the shrine in temple B.

Right: Faience figurine of the Egyptian goddess Sekhmet with the sacred cat, Bastet.

sion carved on the central one.

It is difficult now to decide what the three pillars meant to the temple builders. Perhaps they represented a sacred trinity, for instance, Leto, Apollo, and Artemis; or they may have had origins outside Crete. The closest parallels to such a shrine are similar structures associated with the Phoenicians. Whatever the answer to this question may be, it is clear that the pillars were sacred objects, for wedged between them and surrounding them was a host of special offerings: faience beads, a scarab, bronze figurines of a horse and a bull, and two faience figurines of Egyptian divinities. Behind the pillars, supported by upright slabs placed there later, stood a finely worked shield with repoussé bronze decoration, which had once probably been attached to a backing of wood and leather. Bronze fragments of the shield were found scattered around the shrine.

We have here a perfect amalgam of native Cretan and Eastern elements. Representing the former are the bronze animal figurines and the shield, as well as the terracotta vessels found on the floor. Furthermore, the floor design of the temple with its interior benches conforms to that of other Cretan temples. The Eastern element is represented by the scarab, by the two Egyptian figurines, and probably by the tri-pillar shrine. This same influence is seen in a number of potsherds and faience fragments found lying both inside and outside temple B. The sherds, one inscribed, have been identified as probably Phoenician; the faiences could be North Syrian, Phoenician, or Egyptian. The objects could be either treasured souvenirs from a Cretan's visit abroad or a merchant's wares. The Phoenicians, for instance, are known to have been expanding westward in this period to North Africa, Sardinia, and elsewhere, and Kommos offered abundant fresh water, shelter, and fair anchorage for them on their way west.

As for the rites carried out in the temple, we know that here, as elsewhere, the worshippers offered appropriate gifts, often placing them at the tri-pillar shrine. Behind the pillars and set into the earth floor were the carbonized remains of a wooden bowl. Wine or oil may have been poured into the bowl or,

Bronze figurine of a bull dedicated at the shrine in temple B.

less probably, oil may have been set alight in it to illuminate the shrine from behind. To judge from the cups on the floor, some ceremonial drinking may have gone on. Quantities of bones and shells found in a hearth right in front of the shrine suggest feasting as well as the cooking of meat. At the bottom of this hearth, near the level of its original floor, were a faience bowl and a number of terracotta figurines of animals, perhaps placed there during the original consecration.

The main offerings—the bronze and faience figurines and the shield—raise an interesting question. Small bronze and terracotta bulls have been found in several other sanctuaries in Crete and Greece. One is tempted to make a connection between the animals and the particular deities with whom they may have been ritually or traditionally connected. Such an association would have been especially convenient for us, since the identity of the deities worshipped in the Kommos series of temples remains one of the intriguing and still unanswered questions. It is more likely, however, that the figurines were valuable because they were offered, not because they had any specific symbolic association. So it is with the faience figurines—exotic precious objects that somebody may have acquired in Egypt, or through intermediate Near Eastern merchants. The shield, a symbol of military prowess, could have been offered as a gesture of thanksgiving by a proud warrior.

All these gaps in our knowledge do not prevent us from appreciating the artistry of these objects. The bull, for which there is a long Cretan tradition stretching back to the Bronze Age, stands only 4.2 cm tall but its well-proportioned body and bold modelling clearly convey the animal's strength and virility. In the same way, the horse has stepped beyond the restrictions of a geometric form typical of a slightly earlier period. Aside from the residual tubular shape of its muzzle and trunk, its modelling shows anatomical articulation and an awareness of the interplay of bone, flesh, and muscle. The horse, and possibly the bull, seem to date to the late 8th or early 7th century B.C.

One of the faience figurines, badly worn and only 6.3 cm high, may represent the Egyptian god Nefertum, wearing a kilt, a false beard, and, on his forehead, the ensign of a cobra. His mother, the lion-headed war goddess Sekhmet, a larger figure 15 cm tall, is accompanied by the cat goddess Bastet. The life-giving ankh symbol is held in her right hand, and a long staff of command crowned by a lotus flower is clasped possessively to her chest. She, her son Nefertum, and the god Ptah formed a holy trinity worshipped in the Egyptian city of Memphis. Sekhmet's traditional Egyptian stance, with one leg stepping forward, appears to crystallize the figure in the act of walking. Where the ancient surface is well preserved, one can admire the fine modelling, the shapely rounded arms, the generous feminine curves, and the care for detail. There is an endearing touch to the way the cat clings to her side, as if it were a pet. The Egyptians had already proved themselves masters of a sympathetic portrayal of animals.

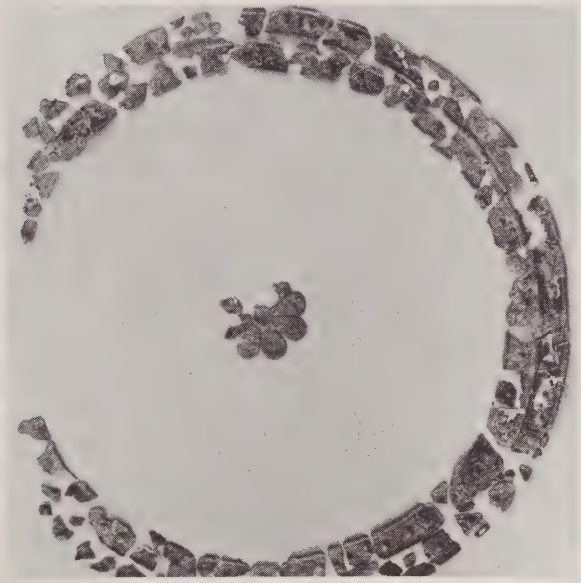
The combination of an indigenous type of Cretan sculpture shown in the horse and bull, and the imported and probably little understood embodiments

Right: One of the archaeologists lifting a pillar in the tri-pillar shrine in temple B. A column base of temple C rests on the pillars.

Opposite page, top left: Shield made of hammered bronze, from the tri-pillar shrine.

Opposite page, top right: Faience figurine of an Egyptian god, probably Nefertum.

of a foreign cult is fascinating historically, especially since the architecture displays a similar complexity. It shows the assertion of local Cretan art and bears testimony to an attitude of receptivity to foreign influence. These were the two conditions that created the necessary climate for self-definition and rich artistic creativity which characterize this period, both in Crete and elsewhere in Greece where similar developments were taking place.



The excavation at Kommos is sponsored by the Royal Ontario Museum and the University of Toronto, under the auspices of the American School of Classical Studies at Athens. Financial support has been supplied by the Social Sciences and Humanities Research Council of Canada, by the sponsoring institutions, and by the SCM Corporation of New York, as well as by private donors.

Initiator of the project and director of the excavation is Dr. Joseph W. Shaw, a Fine Art professor at the University of Toronto, who had previously spent a number of years in Greece and participated in several excavations. Dr. Maria Coutroubaki Shaw, who teaches at Scarborough College, University of Toronto, has had field experience in Greece and is a member of the Kommos excavation team, which consists of numerous other archaeologists and scientists from a number of universities. The authors hold Ph.D. degrees from the University of Pennsylvania and Bryn Mawr College respectively.

Photos: pp. 15 (top right), 16 (top and bottom right), 19 (top left and right) Taylor Dabney; pp. 12-13 (bottom), 14, 15 (top left and bottom), 18 J. W. Shaw; p. 19 (bottom) A. Shaw; pp. 16 (bottom left), 17 R. K. Vincent, Jr.

According to Einstein the planets orbit the sun because they move freely through a space which is curved by the sun's gravity.

A Matter of Gravity

Why Are Black Holes So Attractive?

John Kenny

WHAT'S UP? For that matter, what is down? To our medieval ancestors, these questions had obvious answers. Theirs was a flat world, situated at the centre of the universe. Concepts such as "up" and "down" had an absolute frame of reference. Things fell down because that was the natural thing for them to do—they sought the centre of the universe. Above the earth, the heavenly bodies were attached to transparent spheres. The whole mechanism was held in place and set in motion by divine power. The need for a gravitational force, as we understand it, did not exist.

Until 1543, that is. In that year a timid Polish clergyman, Nicholas Copernicus, proclaimed a sun-centred universe. This notion, coupled with the discovery that the earth was round, effectively destroyed the absolute, universal frame of reference. The meanings of "up" and "down" now depended on where the observer was situated. The divine order had collapsed, leaving in its aftermath a host of questions. If the earth was not at the centre of the universe, why did things fall towards it? What held the planets in their orbits? And if the heavenly bodies behaved like earthly ones, what did they fall towards?

A century and a half later Sir Isaac Newton was able to offer at least partial answers to these questions. Newton's Law of Universal Gravitation was based on the work of two of the greatest scientists of the 17th century: Johannes Kepler, who studied the motion of the planets, and Galileo Galilei, who studied the motion of objects on the earth. The details of Newton's work are obscure, but he claims to have made his discovery by calculating the force required to hold the moon in its orbit around the earth.

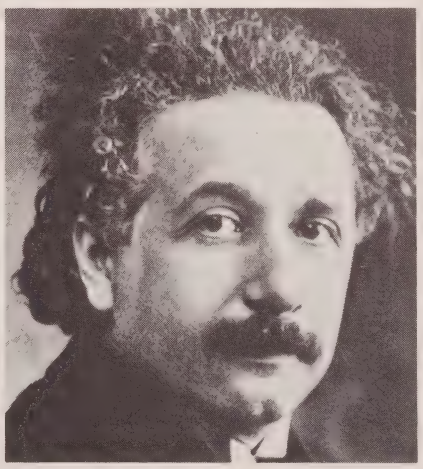
Whatever the process of reasoning, the result was a law which could explain not only events here on earth but also the behaviour of bodies on the astronomical scale. Newton described the force of gravity as the mutual bodily attraction between objects. This force acted instantaneously over large distances.

Although his law met the requirements of rigid mathematical proof, Newton was puzzled by two aspects of his theory. First, the idea "that one body may act upon another, at a distance through a vacuum, without the mediation of anything else" was to Newton unthinkable. He therefore posited the existence of an *aether* which fills space and transmits gravity, just as air transmits sound.

Newton was also puzzled by the fact that his work implied that the universe, filled with gravity as it was, ought to collapse on itself. Unable to think of any other solution, he concluded that the role of God in the system was not to spin the planets on their spheres, but rather to battle against gravity in order to keep the stars in their places. Newton could only describe the effects of a force he did not understand.

What, then, is a "force"? It is simply defined as that which changes the state of rest or motion of an object. Forces appear in many forms: as the pressure of wind pushing a sailboat, as electricity moving a subway train, as gravity pulling an avalanche down a mountain, and in countless other guises.

Above: Isaac Newton discovered the law of universal gravitation, a mysterious attraction between material bodies.



Above: Albert Einstein improved on Newton's work by describing gravity in terms of the geometry of time and space.

Modern physics recognizes four forces. Two of these, known simply as the weak and strong forces, are active only over distances on the atomic scale. Only the other two, the electromagnetic and gravitational forces, directly influence the macroscopic world, that is, the world perceived directly by our senses.

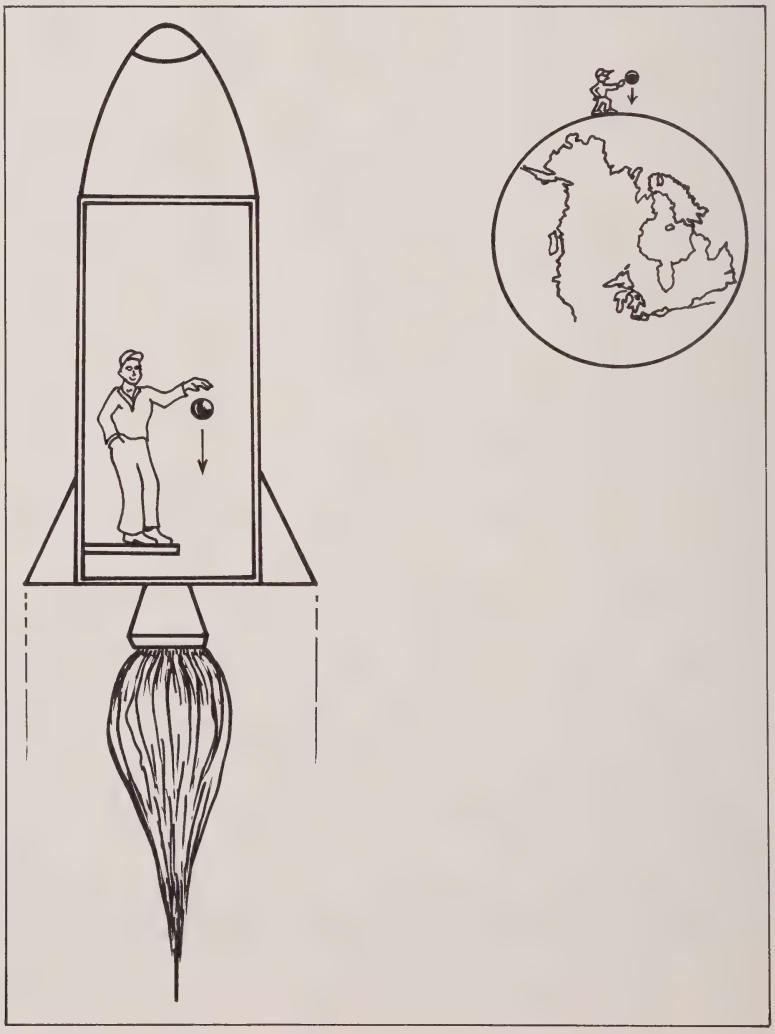
Electromagnetism involves the interaction of electrical charges, which can be either positive or negative. Opposite charges attract, like charges repel. The electromagnetic force is very strong, but it is active only when there is an electrical charge. In the everyday world most objects are electrically neutral.

Of the four forces, gravitation is the weakest. The electrostatic attraction between the positively charged proton and the negatively charged electron in a hydrogen atom is 10^{40} times stronger than their gravitational attraction. Unlike electromagnetism, however, gravitation cannot be neutralized. By equalizing positive and negative charges, electrical interactions can be eliminated. But so far as we know, gravity has only one sign: it is always positive, and it always gives rise to attraction. It cannot be shielded or grounded. It is ubiquitous, all-pervasive, and inescapable.

Although gravity is a weak force, its importance increases with the mass of the objects in question. On the astronomical scale, it is *the* force that shapes the universe. A steel cable the thickness of the earth would not be strong enough to hold the earth in orbit; and yet this mysterious force of gravity does so across 150 million kilometres of space.

Newton's formulae provided a powerful tool for astronomers. They made it possible to determine the sum of all the attractive forces acting on a planet—from the sun, from other planets, and from its own satellites, if any—and to calculate precisely its orbit.

When this calculation was attempted for Uranus after its discovery in 1781, it became apparent that



Right: The principle of equivalence is demonstrated here: both observers see the ball fall down.

Opposite page, top: A ray of light is shone horizontally. As the rocket accelerates upward, the light crosses each successive screen at a point nearer the floor. The principle of equivalence states that gravity must also bend light.

Opposite page, bottom: Light passing near the sun is bent slightly. To an observer on the earth, the star's apparent position (broken line) is shifted outward from its true position (solid line).

the planet did not follow the calculated path. Two young men, John Couch Adams and Urbain Leverrier, suggested that the "irregularities" in Uranus's motion were due to the presence of a large gravitating mass beyond the planet's orbit. In 1846 Neptune was discovered within a degree of the predicted position of this body. In the same manner, perturbations in the orbit of Neptune led to the search for a ninth planet. Pluto's mass, however, is too small to affect significantly the orbit of Neptune. Pluto's discovery in the predicted position was one of those happy coincidences of science.

The 19th century saw great strides in the study of electromagnetism. An Englishman, James Clerk Maxwell, succeeded in describing all known electromagnetic effects in a mathematical form, called Maxwell's field equations. However, although the equations were accurate, they did not fit into the scheme of Newtonian mechanics, which had not changed in more than a century. Clearly the theory of gravitation needed updating to make it consistent with electromagnetism.

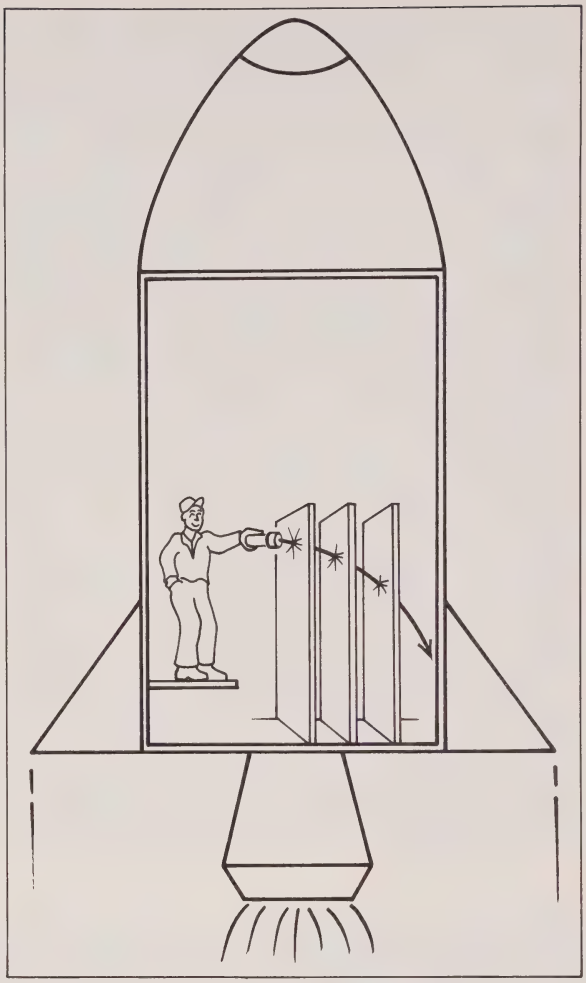
This was the great triumph of Albert Einstein. His general theory of relativity dealt with the fundamental mechanism of gravity head-on. Einstein provided a set of equations which could describe a gravitational field in terms of the mathematical structure of space and time. The equations are described by theoretical physicists as "beautiful and elegant", but to the average person they are virtually incomprehensible. They are so complex that even now they have only been partially solved.

And yet general relativity provides the best description of the physical universe we have. And a strange description it is. In the universe according to Einstein, space is not the normal three-dimensional expanse that was once taken for granted, and time is anything but universal.

Relativity is founded on two assumptions, both well supported. The first is that the speed of light, 299 792.5 kilometres per second, is absolute; it is the same for all observers regardless of their motion. The second is called the principle of equivalence. It states that inertial and gravitational mass are interchangeable. This means that a person in a spaceship that is accelerating with a force equal to the earth's gravity will observe the same effects as a person on the earth.

Suppose you are in such a ship. You shine a ray of light horizontally at a series of fluorescent screens. As the ray travels towards the first screen, the ship is still gaining speed and so the ray intercepts the screen at a point slightly below where you aimed. At each successive screen it hits progressively lower and lower. The ray is being bent. Thus the principle of equivalence predicts that gravity must also bend light.

In 1919 Sir Arthur Eddington confirmed Einstein's prediction. During a total eclipse of the sun Eddington measured the positions of stars close to the dar-



kened sun. He found that their apparent positions had indeed been shifted slightly by the sun's gravity.

It is not that gravity has some mysterious effect that bends light, but rather that in the presence of a gravitating mass space itself is curved. Relativity is a geometrical expression of that curvature. Thus gravity becomes a property of space itself, rather than some mysterious influence imposed on it. The planets orbit the sun not because they are forced by gravity to deviate from straight-line motion, but rather because they move unhindered through a space which is curved by the sun's gravity. In a crude way their motion is like that of a marble rolling around in the bottom of a bowl.

Relativity also implies that a clock in a gravitational field will run slow relative to an identical clock in a weaker gravitational field. This can be confirmed by another thought experiment. Suppose we have a light source which produces one single frequency of light, at x cycles per second. This can be regarded as a kind of clock: it takes one second to produce x cycles. We place our source on the surface of the earth and a detector some distance above it.

Light, like anything else, must expend energy to climb up against the earth's gravity. Since the speed of light is constant it can not do so by slowing down. The light can only lose energy by going to a lower frequency. The detector then will take more than one second to detect x cycles. Time on the earth appears to be passing more slowly to an outside observer. This however is only a relative effect. A person on

Opposite page, top: Artist's conception of a black hole, an enormous curvature of time and space.

Opposite page, bottom: The galaxies are spreading out as the universe expands.

Left: Sir Arthur Eddington observed bending of star light during a total eclipse. (Photo by Alan Dyer, Queen Elizabeth Planetarium.)

the earth would sense that time passes at the same rate. If the same experiment were conducted in reverse, it would appear that time above the earth is passing more quickly.

Within the solar system these effects are quite small. The time dilation on the surface of the earth is only one part in ten million per vertical centimetre. It is only when the gravitational field is very strong—that is, when matter is very dense—that these effects become large. Such is the case with "black holes".

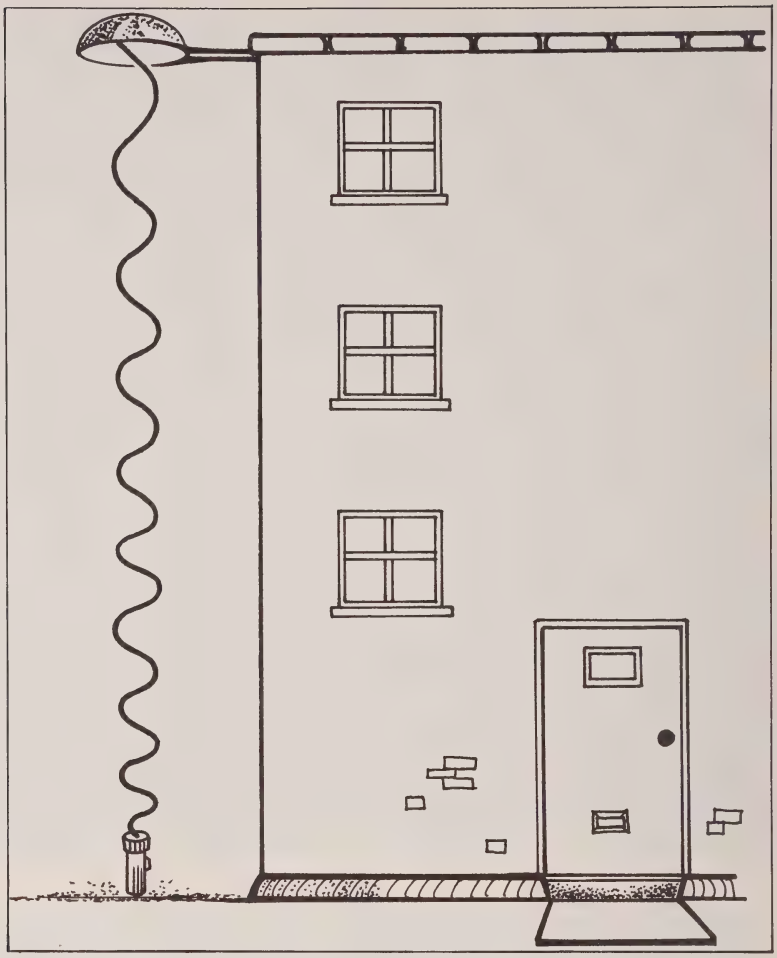
A black hole is one of the possible states to which a star may be reduced at the end of its existence. During the star's normal existence the pressure of the energy released by nuclear reactions in its core balances the gravitational squeeze of its mass. Eventually, however, the nuclear fuels are exhausted. The pressure can then no longer support the star's weight.

Low-mass stars form white dwarves and neutron stars, incredibly dense stellar cinders. The material of a neutron star is so dense that a single teaspoonful would weigh a million tonnes on earth. The pressure of subatomic particles keeps white dwarves and neutron stars from collapsing beyond certain limits.

If, however, the star is massive enough, its gravity will overwhelm even these forces. Once a collapse of this kind begins, nothing in the universe can stop it. The star is crushed by its own gravity into an object of infinite density, a black hole. Here gravity reigns supreme, distorting the properties of space and time in bizarre ways.

From a distance the pull of a black hole is the same as if it were still a star. Close in, however, the density of the black hole creates an intense gravitational field. The closer one gets the more energy it takes to pull away. Eventually there comes a point where the energy required is infinitely large. This point is called the "event horizon". Inside the event horizon gravity is so strong that nothing, not even light, can escape; hence the name "black hole".

It would take all of the light's energy and more to climb out of the hole. This fact has some strange implications for time in the region of a black hole. Think back to our experiment with light rays and time on earth. The stronger the gravitational field the more energy the light had to expend in climbing out of the field, and the greater the apparent slowing of time to an observer outside the field. At the event horizon the energy required for escape is the total energy of the light ray. Time seems to have stopped. An observer watching an object fall into a black hole



Travelling upward against gravity, light is shifted to a longer wavelength and hence a lower frequency; this can be thought of as a slowing of time.

would see the object falling more and more slowly, until at the event horizon it hangs suspended in time forever. If the observer himself were to fall in, the situation would seem quite different. He would flash through the event horizon in a fraction of a second, falling into—well, no one knows quite what. We can never know what lies inside a black hole. It is a space which is so curved that it has folded in upon itself.

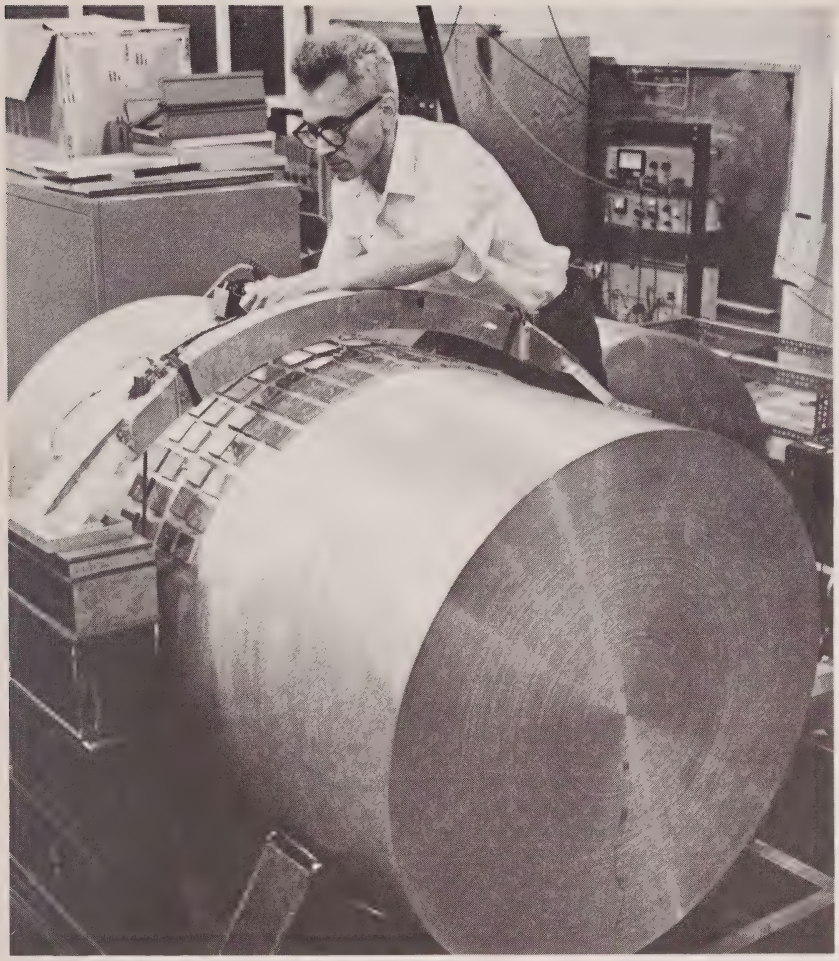
No one knows for sure whether black holes exist. Their very nature makes them very hard to detect. Astronomers have yet to find indisputable evidence of their reality. Joseph Weber, of the University of Maryland, is looking for that evidence in the form of gravity waves.

Gravity waves are ripples in the fabric of space and time, such as would be produced by a rotating black hole. According to theory, most black holes should be spinning. Weber is using a large aluminum cylinder to detect the waves. As the gravity wave passes through the cylinder, the ripple would change the size of the cylinder. So far the results have been ambiguous. Gravity waves and black holes still exist only as outgrowths of gravitational theory.

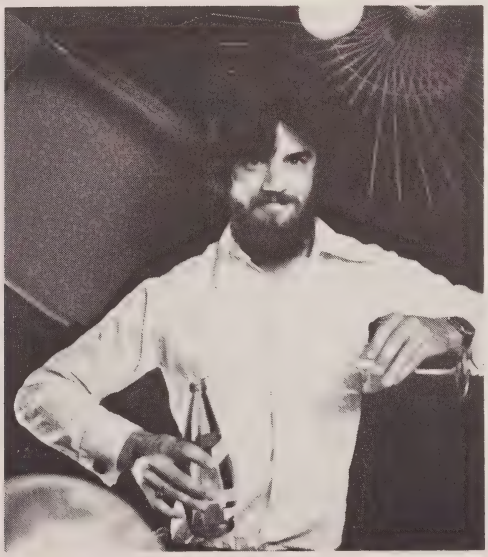
But gravitational theory goes beyond the prediction of strange and fanciful objects. It is the key to the ultimate fate of the universe. At present the universe is expanding: the galaxies are spreading out through space as the result of a colossal explosion, the "big bang" in which the universe was born some 15 billion years ago.

Gravity is gradually slowing the rate of expansion, but will it ever halt the expansion completely? It all depends on whether there is enough matter to curve space completely and close the universe. If there is not enough, then the universe is open and the galaxies will continue to spread out forever. If it is closed, then eventually the expansion will stop. Gravity will then pull the galaxies together again in what has been called the "cosmic crunch".

Such is the present state of our knowledge. But the quest for understanding is endless. As new evidence comes to light it may be that Einstein's theory of general relativity will have to be modified or replaced by a newer and even more daring theory of gravitation. The greatest honour we can do such men is to ensure that the quest continues.



Joseph Weber is trying to detect gravity waves. Delicate sensors on the aluminum cylinder will detect any changes in its size caused by gravity waves.



John Kenny received a four-year B.Sc. from the University of Toronto. During his undergraduate years he worked as a part-time projectionist at the Planetarium. In 1979 he was able to combine his two greatest interests—popular science and the theatre—when he joined the McLaughlin Planetarium as a full-time producer.

Photos: p. 20 Peter Buerschaper, ROM; p. 23 (bottom) Alyson Hannas, ROM; pp. 22, 23 (top), 26 Bill Ireland, McLaughlin Planetarium; p. 24 (bottom) Palomar Observatory, California Institute of Technology; p. 27 (bottom) Chris Sasaki, McLaughlin Planetarium; p. 21 (top) The Science Museum, London; p. 24 (top) Helmut K. Wimmer, from OMNI Feb. 1979; p. 21 (bottom) Yerkes Observatory photo; p. 27 (top) University of Maryland photo.

The Growing Collections

At the close of 1980, the Fashion Group Inc. of Toronto presented a particularly interesting and appropriate gift to the ROM Textile Department. It is a woman's unmade silk dress of the 1760s.

The silk, cut in twelve pieces, is bright yellow, handpainted with sprays of roses, blossoms, and star-shaped flowers in shades of red, blue, purple, green, and white; the petals and leaves are delicately outlined in silver. It was woven and painted in China for the Western market. The beginning and end of the weaving are evident in two of the pieces. All the main components of the dress, except sleeves and ruffles, are extant.

Originally the dress was made up and worn, but subsequently it was unstitched with a view, no doubt, to reassembling it in a newer style. This was a common practice since silks of the period were very expensive. Fortunately this dress was not reconstructed and we now have the pieces as they were first cut out.

The lengths are like a pattern illustrating the extremely simple cut of the sacque gown, or robe à la française. This style, distinguished by its full, flowing, pleated back, was fashionable during the second and third quarters of the 18th century. The total length of all the parts is 16.12 m, and because it includes the beginning and end of the weaving, the silk may well have been woven as a single dress length.

Since its establishment in 1957, the Fashion Group Inc. of Toronto has made significant contributions to the Textile Department. This recent gift will be an attractive and colourful exhibit when the new Costume Gallery is completed. M.H.

A double-breasted morning dress coat of dark blue fine wool tabby, which belonged to Alexander McDonald (1786–1853), has recently been given to the ROM by his great-granddaughter, Miss Naomi McDonald of Picton, Ontario. The coat, made in the United States or Canada between 1838 and 1845, predates the era of the sewing machine.

Mr. McDonald's coat, complete in its original form and documented, is a useful and important addition to the ROM's collection of men's fashionable clothing. M.H.

The Textile Department has acquired a singular smoking jacket, the gift of Mrs. Thelma Rice. It was made by her father, Wesley Allan, who was born in Uxbridge, Ontario, in 1873. When he became a tailor in his early twenties he undertook the making of this jacket which he completed ca. 1899. This masterpiece is made from more than 300 Havana cigar box ribbons in various shades of yellow. The ribbons, which must have taken a long time to collect, have been carefully pieced and machine-sewn in diagonal lines to the shape of the jacket. It is lined, faced, and trimmed with black silk twill.

Although it was worn for many years by Mr. Allan, it still shows clearly the skilled workmanship of an ingenious tailor in 19th-century Ontario, and is a notable addition to the costume collection in the ROM.

M.H.

The European Department has recently received an exceptional example of the jeweller's art dating from the last years of tsarist Russia, about 1900–1917. It is a silver-gilt box (5.7 cm × 10.3 cm × 7.4 cm) executed in the plique-à-jour enamel technique and incorporating numerous pale blue sapphires into a design of blue, yellow, wine, orange, and green enamel, with a large, white sapphire in the centre.

At the turn of the century, plique-à-jour enamelling was occasionally used by Scandinavian and Russian jewellers for luxury objects. The process involves placing powdered glass in a minute metal framework supported over an iron frame coated with clay to prevent the glass from adhering. It is then heated in a kiln until the glass melts and becomes transparent. In the hands of a skilled artisan this exacting process results in delicate fantasies reminiscent of tiny stained glass windows. Prominent French jewellers of the Art Nouveau period also used opaque, off-white plique-à-jour enamel for parts of jewellery; however, their work lacks the size and vibrant colour of the northern European work and sometimes has a greater tendency to chip out.

The best examples of Russian plique-à-jour enamel should be viewed in the context of the brilliant society of the period which centred around the court of the tsar. Jewellers such as Carl Fabergé were creating expensive and carefully executed objects which were often more luxurious than functional. Our box bears the mark of Fabergé's contemporary Ivan Khlebnikov. Because of the lingering nostalgia for old Russia and the craftsmanship inherent in such pieces, they are being sought today by discriminating collectors. We thank Dr. Morton Shulman and Mr. Samuel Sarik for their generous gift made under the terms of Bill C-33. It is an example of artistry worthy of the Museum.

C.P.K.

More than 250 specimens have been added to the mineral collection since August of last year; two of the highlights are pictured here. The first is a magnificent group of clear golden amber calcite crystals, 11 cm × 7 cm × 6 cm, from a relatively newly discovered locality in Tennessee. The second photograph shows a group of quartz crystals, 9 cm × 7 cm × 6 cm, with distinct phantom lines marking earlier growth stages. This specimen from Arkansas was purchased with funds donated by the Kitchener-Waterloo Gem and Mineral Club. R.I.G.

Seven ancient coins were recently donated by Mr. Donald A. Young to the Greek and Roman Department. They include a bronze coin of King Micipsa of Numidia and his brothers, struck about 148 B.C. to 118 B.C., and six bronze coins issued by various Roman emperors. The antoninianus illustrated was struck by the emperor Claudius II (A.D. 268–270). The department sincerely regrets that this gift was incorrectly acknowledged to D. R. Young on page 19 of the ROM's *30th Annual Report*. A.H.E.

All photos Photography Department, ROM.

In August 1980 the Department of Invertebrate Palaeontology received a fine specimen of an undescribed species of hippuritid bivalves. These aberrant relatives of clams and oysters lived during the Cretaceous period about 70 million years ago and had long cylindrical shells which outwardly resembled tusks. They lived clustered in an upright position on the sea floor, forming mounds or reefs with their heavy shells. The second valve, which has been lost on our specimen, was smaller and flatter, acting as a lid on the opening of the elongated one.

This specimen is from Mašon, Yugoslavia. It was given to Dr. Peter von Bitter by Ms. Tea Kolar of the Ljubljana Geological Survey, Ljubljana, Yugoslavia.

J.W.

Charles Darwin was fascinated by beetles. There are almost as many species of beetles in the world as all other kinds of animals combined. And doubtless, many tens of thousands of beetles are still unknown to science.

The Department of Entomology has recently acquired a handsome collection of larger beetles from Malaysia. One specimen, pictured here, is a stag beetle of the family Lucanidae, probably the same family as that of Tom Sawyer's "pinch-bug", immortalized by Mark Twain. There now seems little doubt that the enlarged mandibles of males in this family are used to battle rivals for the right to mate with a female.

D.B.

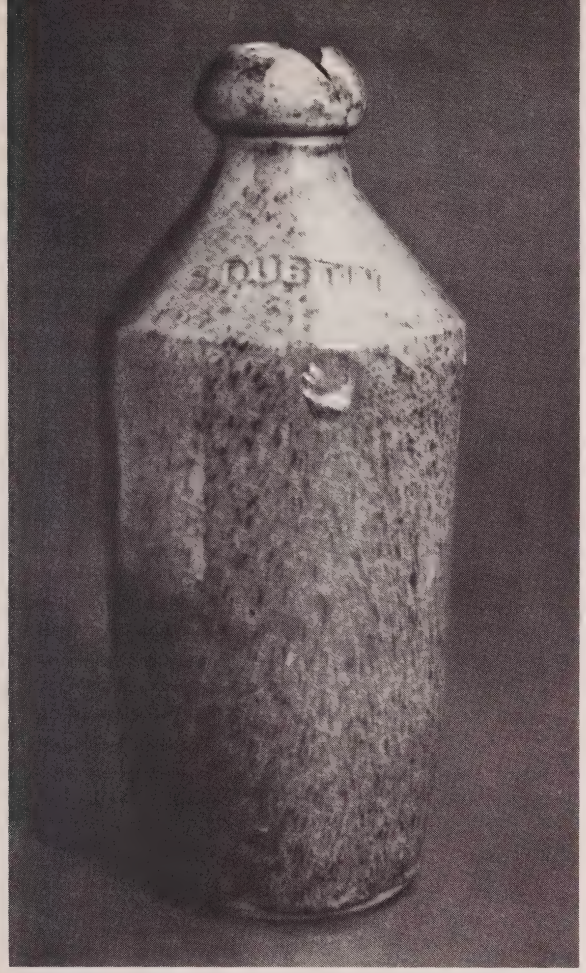
Historical Archaeologists Uncover 19th-Century Workshop

The Morganville Pottery, New York State

David L. Newlands

A VISITOR TO THE VILLAGE OF MORGANVILLE TODAY would describe it as a quiet crossroads community in an agricultural part of Genesee County, New York State. It is one of many small communities that give upper New York State its picturesque image and make the region so attractive to the present generation. Fortunately for the archaeologist, the village has not changed much in the past hundred years: the population is no larger than it was a century ago. The community has not yet been discovered by land developers and a wealth of untouched archaeological resources remain.

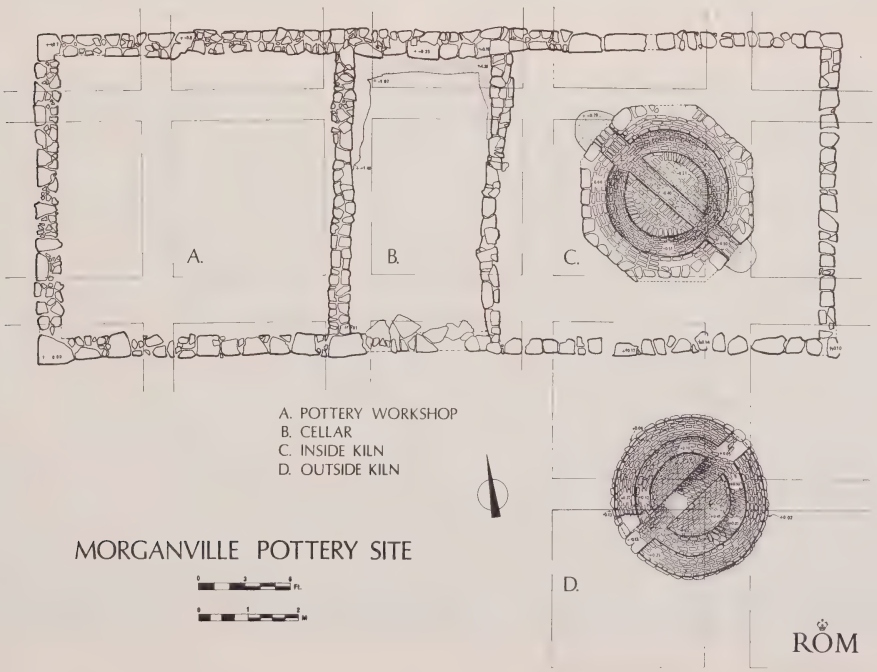
Morganville developed around a waterfall on the Black Creek. This 12.2-m-high falls provided the power for saw and grist mills, which in turn brought artisans to the community. Among these skilled craftsmen were the potters Lyman Gleason and Fortunatus Gleason, Jr., brothers who had emigrated from Westmoreland, New Hampshire in 1827 and 1828. Their reasons for settling in the village are not known, but no doubt they had been affected by the same forces that sent so many Americans into the new territories opening up west of New England. By 1851 Lyman Gleason, who helped his brother to establish the pottery in Morganville, had moved to Paris, Ontario, where he made crocks before opening a temperance hotel. Thus, some of the potters who moved westward influenced the development of the craft in Ontario, for the earliest potters in the Niagara Peninsula were from the United States.



Opposite page: The Morganville pottery in the first years of the 20th century, after the pottery had been closed. The building was left unused until 1930 when it was moved to a new site and updated for use as a residence.

Left: A redware bottle produced for S DUSTIN, *a druggist in nearby Batavia, New York State. Potters produced special orders of bottles and crocks for business use.*

Below: A detailed, scaled drawing of the pottery and kilns made during the excavations in the summer of 1973.



The site of the Morganville pottery was a parcel of land purchased by Fortunatus Gleason, Jr., in 1828. Here he built a simple frame structure with board and batten covering. The building was situated on a small lane running parallel to the main east-west road through the village, and had easy access to the main north-south road.

A succession of owners operated the pottery from its beginning until it was closed ca. 1900. Although Fortunatus Gleason, Jr., continued to make pottery into the 1850s, he was forced to sell the business in 1837, possibly as a result of the depression that year. Another brother, Wilson Gleason, of Westmoreland, New Hampshire, bought the business in 1837 for $1500, but eight years later he sold it for $700 to Charles Gleason, Fortunatus's son. Father and son worked the pottery until 1860, when it was turned over to James A. Brown, another potter from New Hampshire, who had married Charles's sister. A man called Charles Ford, who worked the pottery with James Johnson from 1870, eventually took over the business and continued to make crocks until about 1900 when the pottery was closed.

The 1860 census gives us the best-known description of the business. It reports that Brown employed three hands to make eight thousand drain tiles a year at a value of $1200, and thirteen kiln-loads of pottery valued at $1300. Ninety wagon-loads of clay and one hundred cords of wood were used to make these; the total cost of raw materials was $285. The pottery employees were Peter Brosmer, born in Germany; John Greene, born in England; and George Proser, formerly employed at the Alvin Wilcox pottery in West Bloomfield, New York.

There have been very few archaeological excavations of potteries in New York State. Thus the excavation of the Morganville pottery provided valuable information on pottery types manufactured in upper New York State in the last half of the 19th century; it also furnished unusually complete information on the construction of pottery workshops and kilns. Furthermore, the comparison of redware shapes, decorations, and glazes in New York State with those in Ontario helps Canadian archaeologists to connect the earliest pottery produced in the Niagara Peninsula with its American antecedents.

In the summer of 1973 the Rochester Museum and Science Center, which has provided the leadership for New York State pottery excavations, sponsored the excavations at the Morganville pottery. The author was invited to join in the field work under the direction of Daniel Barber of Rochester. Before the start of the field season a class of anthropology students from Brockport State College cleared the site of a dense overgrowth of trees and shrubs, and removed large field stones that had been piled over the foundations of the pottery. The site was preserved because it had been used by a local farmer since 1930 as a dump for stones. The growth of tall trees since 1900 over the entire site meant hard work for the archaeologist, but was a natural deterrent to amateur diggers and collectors. When field work began the clearly visible outline of the pottery building and kilns supplied a convenient guide for laying out a quadrant grid system over the area.

The pottery excavations uncovered the foundations of the building, the lower parts of two kilns,one inside and one outside the building, and a large number of sherds. The building was 16 m × 6.8 m, with a cellar of smaller dimensions (labelled B) dug to a depth of 1 m. Here the potter stored clean clay during the winter to keep it from freezing. The kiln inside the pottery had a foundation with an outside wall of stone laid in a hexagonal shape. The stone

Left: View of the Morganville pottery site looking eastward after the initial clearing of brush and rocks. The outline of the building foundations and two kilns, one inside the building on the eastern end and the second on the south side (right of picture) are clearly visible.

Right: Examples of flowerpots produced at Morganville pottery. Flowerpots were a major product of all redware potteries.

extended from the base of the kiln to the level of the floor of the pottery, a distance of about 0.8 m. This kiln was an up-draft type and had a beehive superstructure. According to Clinton Ford, Charles Ford's son, the kiln was high enough for a potter to stand up inside to stack pots before firing. The kiln was enclosed in a bottle-shaped brick structure called a hovel, which passed through the roof of the building to form a chimney.

This indoor kiln had a main flue in an approximately northwest-southeast direction connected to a circular flue going around its interior. Both the brick flues were between 0.4 m and 0.5 m below the level of the building's floor. Wood was fed into the kiln through the firemouths which were about 0.7 m below the floor and had a small circular depression in front. The heat from the fires of an up-draft kiln passed directly around the pots stacked in the centre of the kiln, then upward and through the top of the hovel to the outside of the building. The fires were hard to control, since the amount and quality of wood fed into the kiln, the wind direction and intensity, and the wares being fired all influenced the success or failure of the firing process. When kilns were being fired, the potter had to give complete attention to the process if his weeks of work in making the pottery were not to be wasted.

Somewhat later a second kiln was constructed out-of-doors immediately south of the building. It was built by cutting a circular trench into the subsoil and placing large stones in it. The area around these stones was filled with brick debris to form a level surface. A layer of pebbles was laid on top of this, and covered with about 2.5 cm of cement into which a layer of ordinary house brick was laid. The circular base provided a platform 3 m in diameter for the beehive-shaped superstructure. Thus the kiln could be repaired or completely rebuilt without replacing the base. This outdoor kiln was about 4 m high at its tallest point and had an internal flue system similar to that of the indoor kiln, but with the flue in a northeast-southwest direction, probably to utilize the wind coming around the outside of the building. The outdoor kiln, made of ordinary brick, was in a remarkable state of preservation with more than 1 m of its structure remaining in place. It is rare to find kiln evidence at all, let alone so much of the original structure remaining.

One of the questions we pondered during our investigation was why two kilns had been built at the same site. A number of archaeologists have suggested that the outdoor kiln was built after the indoor one was no longer in use, but there is no evidence to support this conclusion. The picture of the building, taken after it had been abandoned, does not show the chimney of the hovel projecting above the roof line, but this may be due to the fact that the kiln had been dismantled and the bricks reused after the business was closed. It is also possible that the outdoor kiln was used for firing unglazed ware, such as drain tiles and flowerpots, while the indoor kiln was used for firing glazed ware. A large percentage of the sherds found near the outdoor kiln were unglazed, but this may have been a result of dumping ruined pottery.

During the seventy years the business was in operation an unusually diverse assortment of ware forms was produced. The author has prepared a guide to the pottery forms from the site illustrating twenty-two different forms, most of them in a number of different sizes. In unglazed ware the potters produced drain tiles, stove tubes, ordinary flowerpots, and hanging flowerpots. Glazed wares included utility bowls, plates, bowls, jars, jugs, spit-

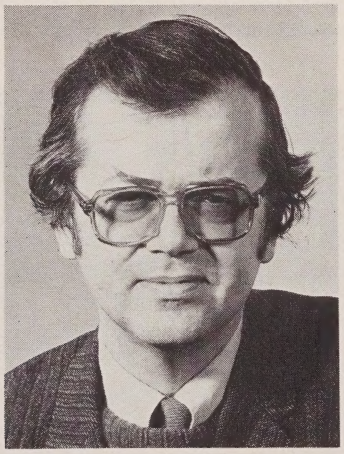
toons, chamber pots, and pottery bottles. A number of complete bottles marked S DUSTIN were retrieved; one of them is illustrated. Dustin was a druggist in the town of Batavia who had placed a special order for the bottles at the pottery.

The range of glazes used at Morganville was restricted to light green, light tan or rose, and a clear glaze with manganese or iron additives which gave a speckled finish. Some of the jars and crocks were decorated with a band of four parallel incised lines below the rim. Occasionally a jar would have two bands separated by a wavy band design. Some of the pots were impressed with C GLEASON/MORGANVILL [*sic*] or with just MORGANVILL. It was not common for potters to impress their names on redware, and so the presence of marked wares at the site provides sound evidence for attributing certain distinctive unmarked products to the Morganville pottery.

The largest collection of Morganville pottery is at the Le Roy House in Le Roy, New York. It was collected by Mrs. Mae B. Kenney of the Le Roy Historical Society long before collecting local crafts had become a popular interest.

Although the Morganville pottery had the competitive advantage of being the only one in Genesee County, its survival along with that of the other pottery workshops in upper New York State was threatened. The development of pottery machinery and other kinds of containers for storing food doomed the small rural pottery. Glass and metal containers became popular, and milk-skimming machines removed the demand for the clay pans that had formerly been used. By the mid-1850s drain tile was being made in New York State by small hand-operated machines, thus increasing the productivity of the few potteries able to purchase the machinery, and removing drain tiles from production in the other establishments. By the opening years of the 20th century, most of the small redware potteries of upper New York State and Ontario had closed. In the past eighty years all evidence of these pottery sites has been obliterated. The well-preserved remains of the Morganville pottery have provided historical archaeologists with many answers to questions about 19th-century technology and craft.

The outdoor kiln during the early stages of excavation. The kiln was constructed of ordinary brick laid to form a circular structure.



Photos: p. 35 Bill Robertson, Photography Department, ROM; p. 32 Le Roy Historical Society; p. 36 Photography Department, ROM; pp. 33, 34, 36 (top) Rochester Museum and Science Center, Rochester N.Y.

David L. Newlands is a research archaeologist with the Canadiana Department of the ROM and the coordinator of the graduate programme in Museum Studies, University of Toronto. He has written extensively on Ontario redware and stoneware potteries and is the co-author of An Introduction to Canadian Archaeology, *published by McGraw-Hill Ryerson in 1976. His most recent publication is* Early Ontario Potters: Their Craft and Trade *(McGraw-Hill Ryerson, 1979). He is currently working on a detailed analytical report on the Morganville pottery excavations.*

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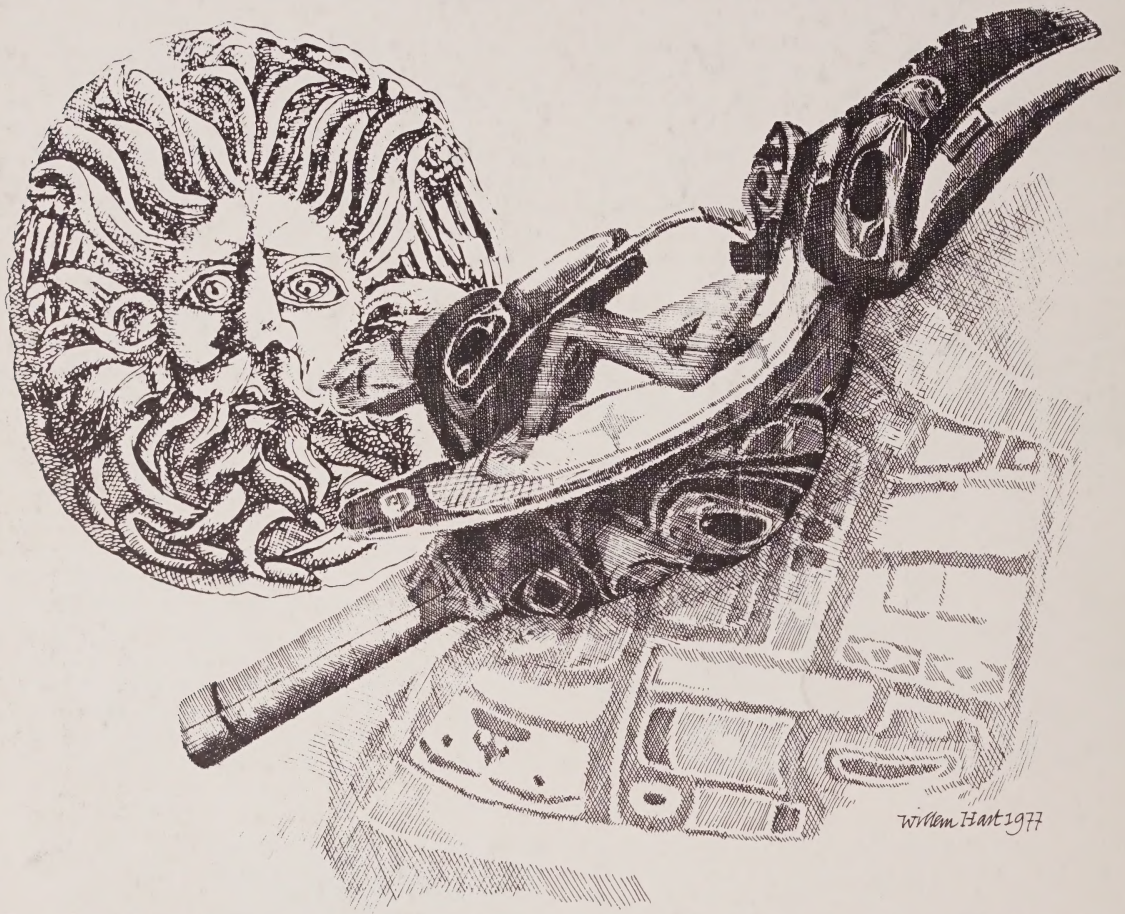

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